398. **Proposed by C. N. SCHMALL, New York City.**

In a square $ABCD$ draw the diagonal AC. Now bisect AD in G and draw GB cutting AC in H. Prove that $\triangle AGH=\frac{1}{2}\triangle CGH=\frac{1}{3}\triangle ABG=\frac{1}{4}\triangle BCH$.

Solution by A. H. HOLMES, Brunswick, Maine, and G. I. HOPKINS, A. M., Manchester, New Hampshire.

Since $BC=2AG$ by construction, and $\angle CBH=\angle GAH$, $CH=2AH$. But the altitudes of triangles AGH and CGH are the same.

$\therefore \triangle AGH=\frac{1}{2}\triangle CGH$.

For the same reason as above, $BH=2GH$.

$\therefore BG=3GH$.

The altitudes of triangles AGH and ABG being the same, $\triangle AGH=\frac{1}{3}\triangle ABG$. Since the homologous sides in triaugles AGH and BCH are one-half the size in the former of those in the latter, $\triangle AGH=\frac{1}{4}\triangle BCH$.

Also solved by J. Scheffer, Francis Rust, M. A. Muzzy, and H. C. Feemster.
A. M. Harding should have received credit for solving 397.

399. **Proposed by J. K. ELLWOOD, Superintendent of Schools, Lucas, Kansas.**

A race track is to be composed of two tangents and the arc of the circle which is concave towards the point of intersection of the two tangents, each tangent and the arc of the circle being 1 mile. What is the radius of the circle?

Solution by CHRISTIAN HORNUNG, Heidelberg University, Tiffin, Ohio.

Let AT and BT be the tangents, and ACB the arc composing the track; O the center, and OA the radius of the circle.

Let $AOT=\theta$, and $AO=r$. Then arc $ACB=(2\pi-2\theta)r=1$, and $\tan\theta=1/r$; whence $\tan\theta=2(\pi-\theta)$.

This equation solved by approximation gives

$$\theta=74^\circ\ 46'.18. \qquad r=\frac{1 \text{ mile}}{\tan\theta}=\frac{5280 \text{ feet}}{\tan\theta}=1437.45 \text{ feet}.$$

Also solved by J. E. Sanders, A. M. Harding, J. Scheffer, H. Prime, A. H. Holmes, Elmer Schuyler, E. B. Escott, and H. C. Feemster.

CALCULUS.

321. **Proposed by ARTEMAS MARTIN, Ph. D., LL. D., United States Coast and Geodetic Survey Office, Washington, D. C.**

To a person in a boat at the center of a circular pond the bottom appears to be perfectly level. What is the actual form of the bottom of the pond, the depth of the water at the center being a feet, and the distance of the eyes of the observer from the surface of the water being b feet. [From the *Mathematical Visitor*, Vol. 2, No. 2, p. 62.]

Solution by E. B. ESCOTT, Ann Arbor, Michigan.

Let A be the bottom of the pond at the center, OX the surface of the water, B the observer. Then $\sin\theta=m\sin\phi$.